

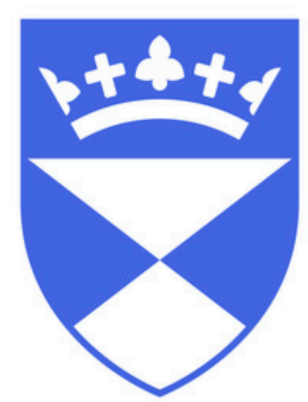
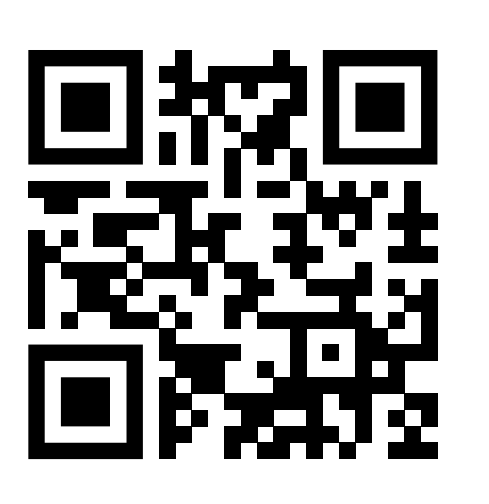
RAPiD: A novel simulated e-Learning tool for *Relative Afferent Pupillary Defect* Identification

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A relative afferent pupillary defect (RAPD) is an important but uncommon neurological sign¹. We hypothesised that **accurate recognition of an RAPD is low amongst medical students**. Existing learning is mainly through static charts as shown in figure 1, or through simulators built for other purposes or don't provide feedback. To address this we created a **novel, simulated e-Learning tool** (Fig. 2) to help users practice examination technique ('Swinging Light Test') and diagnosis.

We carried out assessment of this tool across two medical schools (Edinburgh & Dundee) and an ophthalmology department to *evaluate efficacy* (Ethical approval: UOD-SMED-SLS-Staff-2025-25-69). Respondents were invited by email and online notice board to complete the online 11-item survey (with embedded HTML5 learning tool).

Survey questions included role, ophthalmology experience, confidence (on a 5-point scale) and efficacy, pre- and post- tool.

KEY FINDINGS

- Most medical students can diagnose an RAPD correctly (69.2%)
- **We created a novel, free-to-use RAPD teaching simulator**
- Self-reported confidence in RAPD diagnosis *increased* post-simulator ($p < 0.001$)
- Accurate diagnosis of RAPD (presence & laterality) *increased* post-simulator ($p = 0.0574$)

Results

45 users completed our model evaluation over a 3 month period (30/10/25 - 29/12/25). The majority were medical students (86.7%, $n = 39/45$) and in their clinical (defined as years 4-6) years, (92.3%, $n = 36/39$). Most respondents had either worked or had placement in ophthalmology (64.4%, $n = 29/45$) but most felt 'neutral', 'unconfident' or 'very unconfident' in diagnosing an RAPD (82.2%, $n = 37/45$) prior to using the simulator.

Most users were able to diagnose the absence of an RAPD even prior to using the simulator (86.7%, $n = 39/45$), but a large number struggled to recognise or lateralise an RAPD correctly (62.2%, $n = 28/45$), as demonstrated in figure 3. Most medical student were able to diagnose an RAPD correctly (69.2%, $n = 27/39$). The majority of users reported feeling 'fairly' or 'very' confident in diagnosing an RAPD following simulator use (75.6%, $n = 34/45$) as shown in figure 4. The increase in users reporting 'fairly' and 'very' confident was *almost fourfold* (9 to 34).

The increase in user ability to diagnose an RAPD correctly (presence and laterality) following simulator use, demonstrated in figure 3, was not statistically significant with a McNemar test ($p = 0.0574$). However the *increase in self-reported confidence after using the simulator was highly statistically significant* (McNemar test, $p < 0.001$).

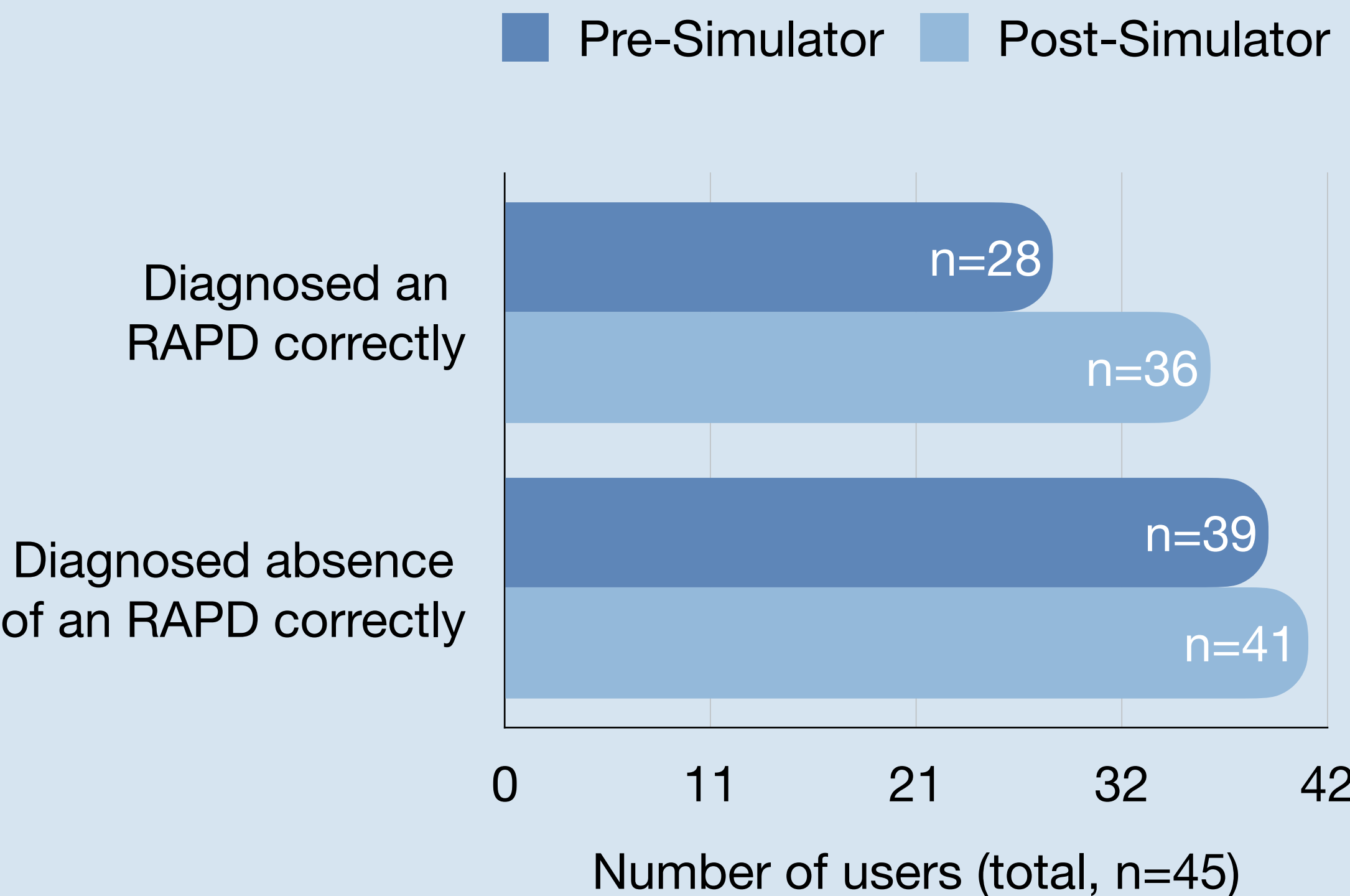


Fig. 3: A bar chart demonstrating the number of users (total, $n = 45$) diagnosing an relative afferent pupillary defect (RAPD) correctly (for presence and laterality) before and after using our simulator.

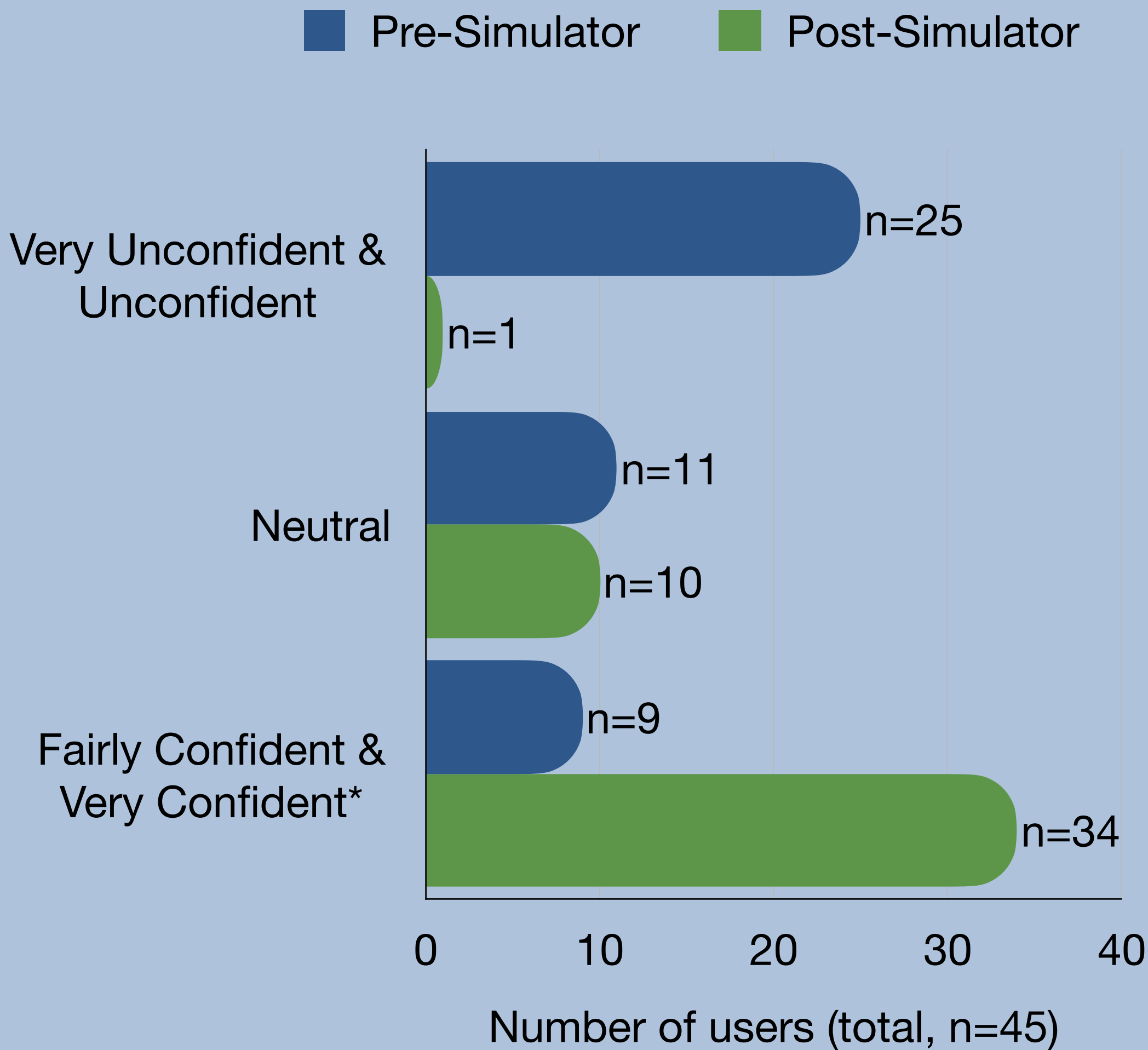


Fig. 4: A bar chart highlighting user (total, $n = 45$) self-reported confidence in diagnosing an relative afferent pupillary defect (RAPD) before and after simulator use. *8 users reported being very confident following simulator use, compared to 0 prior.

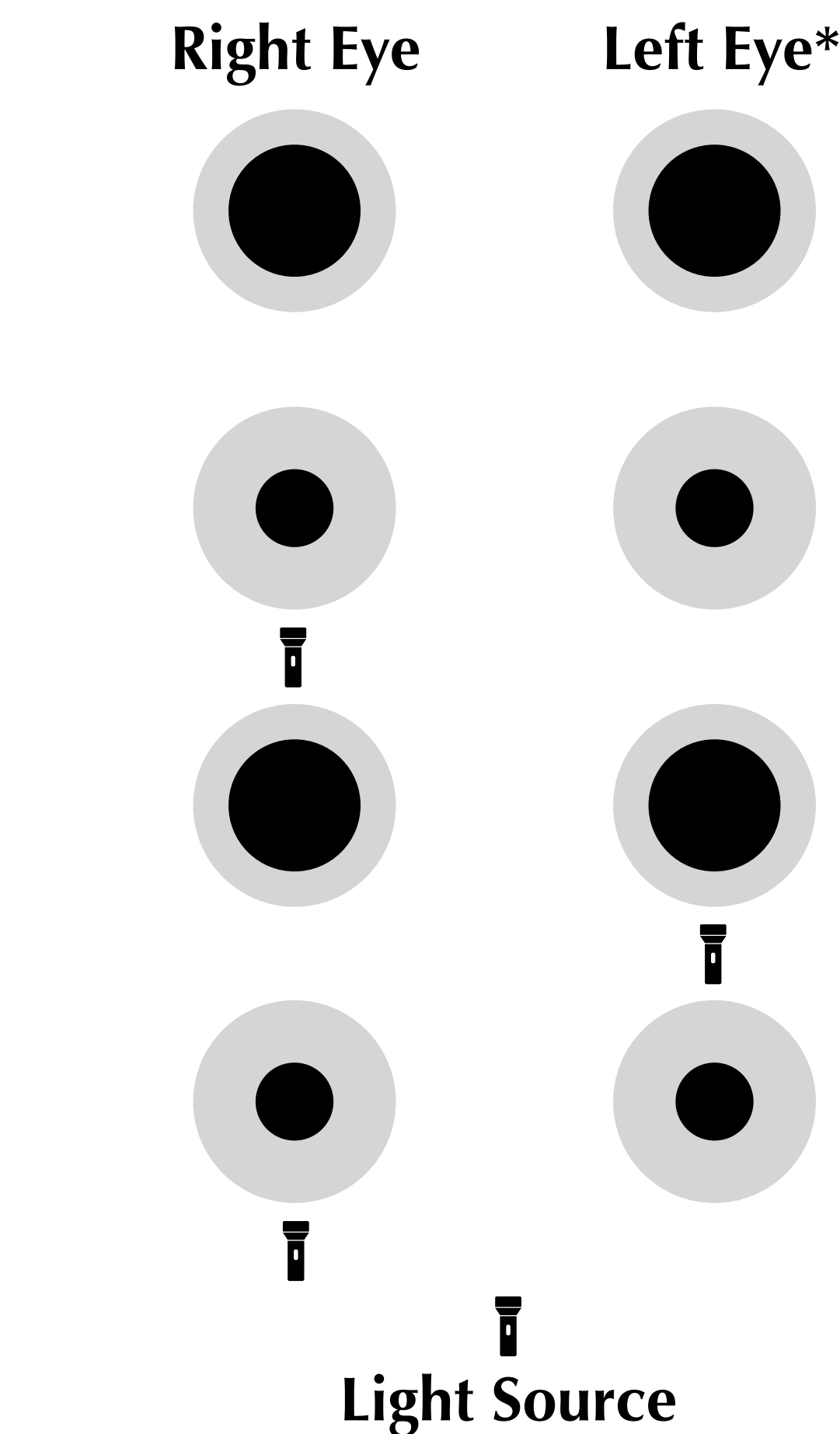


Fig. 1: A traditional static flowchart explaining the 'swinging light test' for a ***left-sided** relative afferent pupillary defect (RAPD)

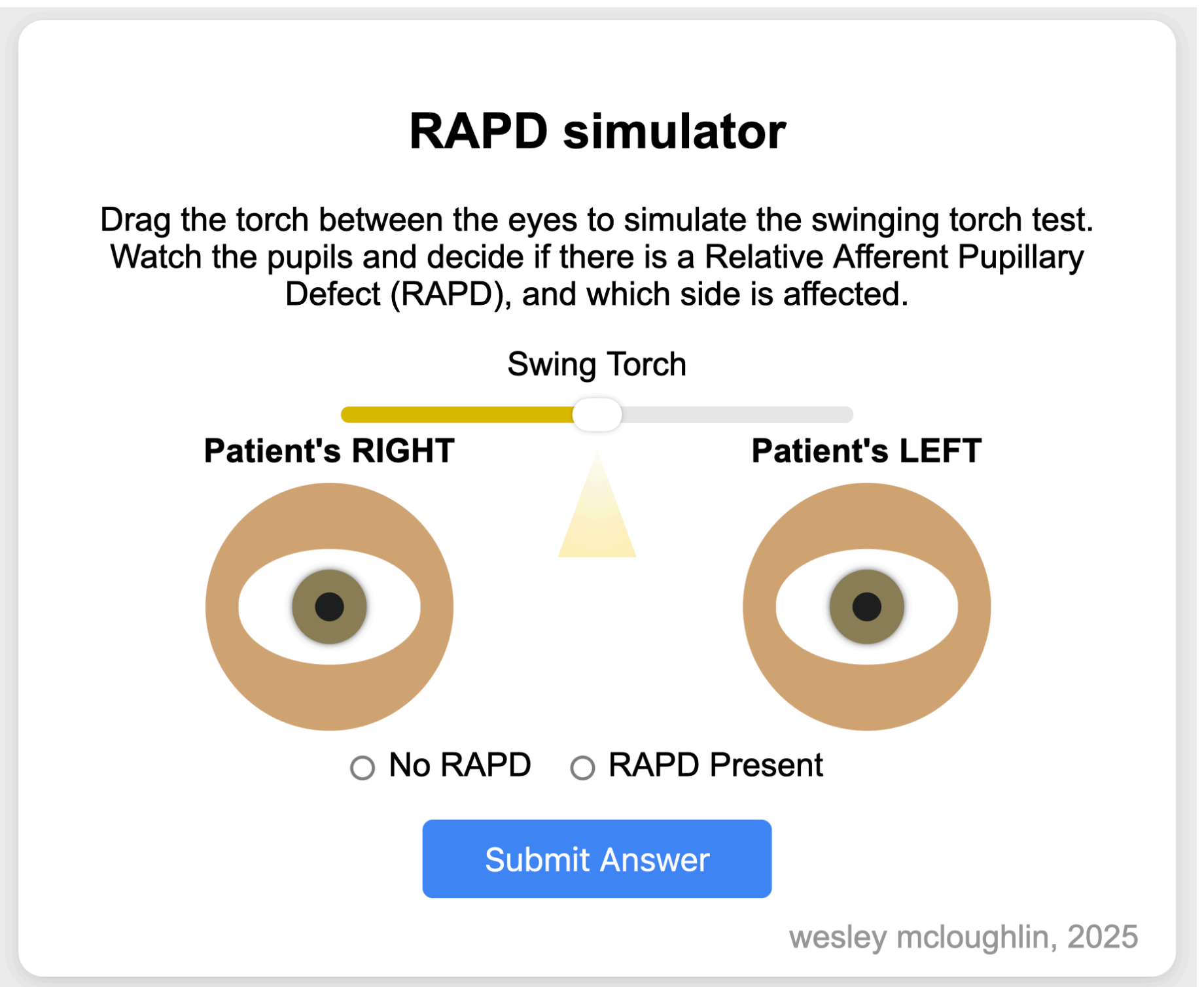


Fig. 2: Screenshot of the user interface of the relative afferent pupillary defect (RAPD) simulator. Users can drag the torch side to side to test pupillary responses before inputting their answer (RAPD presence and laterality) and receiving feedback. **To try it for yourself:** wkxm.org/rapd

Conclusion

Our findings demonstrate that most medical students are able to diagnose an RAPD correctly. The results of our research support the use of targeted fidelity simulators and simulated e-Learning tools which can aid education in diagnosis and examination technique.

Our RAPiD simulator was associated with a large, statistically significant increase in self-reported confidence along with an increase in correct diagnosis (laterality and presence). These results support further research in developing and evaluating similar tools which can help learners gain experience of important, uncommon clinical signs.